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E85 Driver Information

Model: E85

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Understand the operation of E85 instrument cluster
- Perform instrument cluster test functions
- Locate and identify components involved with the E85 instrument cluster

Driver Information

Instrument Cluster

The instrument cluster in the Z4 has a sporty appearance in line with a roadster. The instrument cluster is very compact. The needle instruments are integrated in 2 housing attachments. The two needle instruments for the speedometer and the tachometer are thus the predominant visual features.

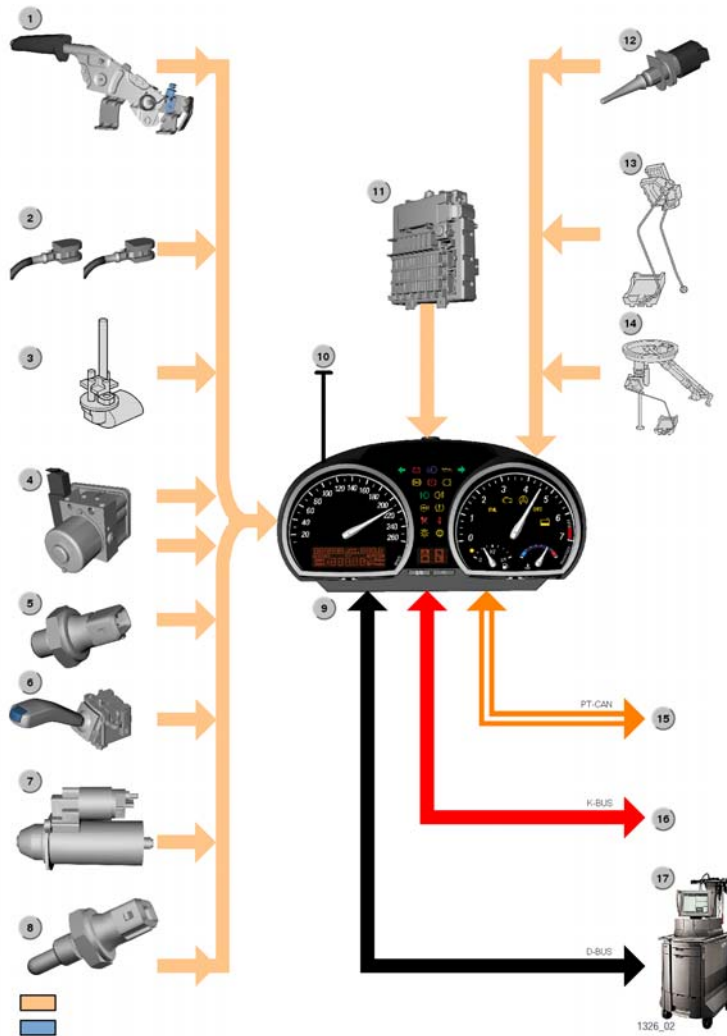


The needle instruments for the fuel gauge and the coolant temperature gauge are integrated in the tachometer. The speedometer incorporates an LC display, which shows e.g. the total mileage (odometer), the trip distance (trip odometer), the time, the on-board computer functions and the SIA service interval indicator.

Between the large needle instruments are the indicator and warning lamps and the program and gear display. The program and gear display is only featured in vehicles with automatic transmissions and SMG sequential manual gearboxes.

The instrument cluster is the central gateway in the bus network.

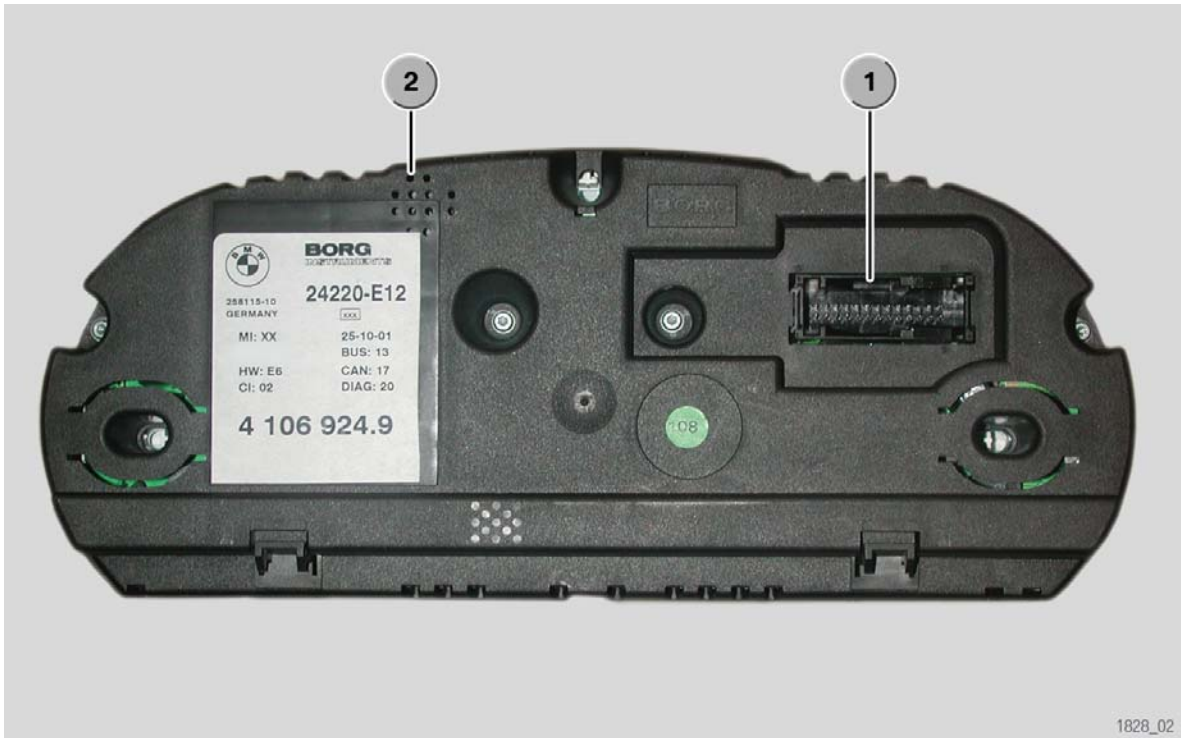
System overview



Index	Explanation	Index	Explanation
1	Parking Brake Switch	10	Ground Supply Terminal 31 (KL31)
2	Brake Pad Wear Sensors	11	Fuse Box
3	Coolant Level Switch	12	Outside Temperature Sensor
4	DSC Control Unit	13	Fuel Tank Sensor 1
5	Oil Pressure Switch	14	Fuel Tank Sensor 2
6	Turn Signal Switch	15	PT-CAN Bus
7	Starter Terminal 30H	16	K-Bus
8	Reverse Light Switch	17	D-Bus
9	Instrument Cluster		

Instrument-Cluster Plug Connection

The 26-pin plug connection is located on the reverse side of the instrument cluster.



New System Features/Modifications

The main feature of the instrument cluster in the Z4 is its new design:

- The indicator and warning lamps between the needle instruments. The coolant temperature gauge and the fuel gauge are integrated in the tachometer.
- Additional indicator and warning lamps (e.g. Electric Power Steering EPS) are integrated.
- The automatic gearbox or Sequential Manual Gearbox SMG has a liquid-crystal display for indicating the gear.
- The instrument cluster of the Z4 has a gateway function between the bus systems (as in the E46) K-Bus, PT-CAN Bus and diagnosis bus.
- The lighting of the instrument cluster is controlled by means of the K-Bus.
- The instrument cluster has a modified voltage supply with undervoltage detection.
- The acoustic alarms and test functions have been expanded.

System Components

The instrument-cluster system comprises the following components:

- Needle instruments
- Indicator and warning lamps
- LC display
- Program and gear display for automatic gearbox and SMG Sequential Manual Gearbox
- Acoustic generator for outputting acoustic alarms
- Acoustic generator for outputting turn-signal flasher rate
- Two setting buttons, integrated in instrument cluster
- Connected components which serve to activate the displays/ indications in the instrument cluster (see system overview/system schematic)



Display Areas

The instrument cluster is divided into the following display areas:

- Needle instruments
- Indicator and warning lamps
- LC display
- Program and gear display for automatic transmission and Sequential Manual Gearbox (SMG)

Instrument-Cluster Lighting

The speedometer and the tachometer are illuminated by slit light between the dial face and the graduated dial. The brightness of the dial-face, needle and display illumination (dimming) is determined by the LSZ light switch center. The lights ON signal is transmitted from the LSZ light switch center to the instrument cluster (via the K-Bus). The dimming signal is also transmitted via the K-Bus. The LSZ evaluates the following input signals to control dimming:

- Dimmer (knurl in light switch center)
- Photoelectric cell for ambient brightness (in light switch center)

Because the dimming signal is sent via the K-Bus, there is no need for terminal 58g.

Instrument Cluster Power Supply

The power supply of the instrument cluster is by means of a switching controller. The switching controller compensates for voltage fluctuations of the vehicle electrical system in the range from 9 V to 16 V.

Undervoltage: the vehicle voltage is measured as of terminal 30 every 30 milliseconds. As of a voltage of approx. 7.5 V, undervoltage is detected. Then, no more read and write accesses are permitted to the EEPROM. Prior to a possible undervoltage reset, the instrument cluster initiates a data backup.

Overvoltage: overvoltage is detected in the case of a voltage >16 V. The microcontroller initiates measures to back up the hardware. Data (mileage, SIA data, time, date, etc.) or states are not lost because they are stored in good time. Indicator and warning lamps are switched off or dimmed for the duration of the overvoltage.

Undervoltage Detection

The instrument cluster incorporates an undervoltage-detection facility. Undervoltage detection is performed in the instrument cluster with the aid of a comparator (software-based voltage comparison).

Note:

Overvoltage in the electrical system is also detected. In the event of a system voltage >16 volts, it is possible for:

- Inputs and outputs to be deactivated
- Indicator and warning lamps to be deactivated or dimmed for the duration of the overvoltage

Coolant Temperature Gauge

In the event of coolant over-temperature, a warning sound is issued when the red indicator and warning lamp lights up. The signal is delivered by the DME via the PT-CAN Bus.

Fuel Gauge

The indicator lamp is activated when the fuel reserve drops below a threshold coded at the plant (standard = 8 liters).

Indicator Lamps

There are a total of 24 indicator and warning lamps in the instrument cluster of the new Z4. The following two lamps are new additions to the established lamps:








- Indicator lamp for EPS: The Electric Power Steering system is used in the new Z4 for the first time.
- Indicator lamp for lamp monitoring: This lamp indicates lamp failure in the headlights, rear lights and brake lights and is activated by the light switch center.

The instrument cluster receives input signals through the following channels:



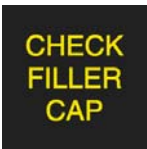
- Via the K-Bus
- Via the PT-CAN Bus
- Directly from the sensors

Symbol	Color	Meaning	Activated by	Active from Terminal:	Pre-drive check
	Green	Left Turn Signal	LSZ via K-Bus	Terminal R	N/A
	Green	Right Turn Signal	LSZ via K-Bus	Terminal R	N/A
	Red	Battery Charge Indicator	DME via PT-CAN	Terminal 15	N/A
	Blue	Main Beam/Light Signal	LSZ via K-Bus	Terminal R	N/A

Symbol	Color	Meaning	Activated by	Active from Terminal:	Pre-drive check
	Red	Low or No Oil pressure	Oil Pressure Switch	Terminal 15	1 second yellow followed by 1 second red
	Yellow	Low Oil Level	DME via PT-CAN	Terminal 15	N/A
	Yellow	ABS Inactive	DSC via dedicated signal line	Terminal 15	2 Seconds
	Red	General Brake Warning Light - Parking Brake	Handbrake switch	Terminal 15	1 second yellow followed by 1 second red
	Red	Low Brake Fluid Level	DSC via PT-CAN		N/A
	Red	EBV Inactive	DSC via PT-CAN		N/A
	Yellow	DBC Inactive	DSC via PT-CAN	Terminal 15	N/A

Symbol	Color	Meaning	Activated by	Active from Terminal:	Pre-drive check
	Yellow	Brake lining wear	Brake lining wear sensors and algorithm in instrument cluster	Terminal 15	2 Seconds
	Green	Front fog lamps	LSZ via K-Bus	Terminal 15 and Terminal 58	
	Yellow	Fuel reserve	Fuel tank sensor and algorithm in instrument cluster	Terminal 15	2 Seconds
	Yellow	Electric Power Steering Fault	EPS via PT-CAN	Terminal 15	2 Seconds
	Yellow	System failure during initialization	DSC via PT-CAN	Terminal 15	1 second yellow and then 1 second red (if coded)
	Red	Tire pressure loss			
	Red	Airbag Warning Light (AWL)	ASE system via K-Bus	Terminal R	2 Seconds

Symbol	Color	Meaning	Activated by	Active from Terminal:	Pre-drive check
	Red	Fasten seat belts	ASE via K-Bus	Terminal 15	6 seconds
	Yellow	Check Control - Lamp Fault	LSZ via K-Bus	Terminal 15	
	Yellow	Transmission failsafe program	EGS/SMG via PT-CAN	Terminal 15	2 seconds
	Yellow	Electronic engine power control	DME via PT-CAN	Terminal 15	
	Yellow	Service Engine Soon (MIL)	DME via PT-CAN	Terminal 15	
	Yellow	ASC - controlling or inactive	DSC via PT-CAN	Terminal 15	2 seconds
	Yellow	DTC controlling	DSC via PT-CAN	Terminal 15	

Symbol	Color	Meaning	Activated by	Active from Terminal:	Pre-drive check
	Yellow	Coolant level	Coolant level switch	Terminal 15	
	Red	Coolant over-temperature	DME via PT-CAN	Terminal 15	2 seconds
	Yellow	Open tank filler cap	DME via PT-CAN	Terminal 15	

Pre-Drive Check

The Pre-drive Check is a test of important indicator and warning lamps. In the Pre-drive Check, these indicator and warning lamps are activated for 2 seconds with terminal 15 ON.

All the indicator and warning lamps are deactivated at the end of the Pre-drive Check.

LC Display

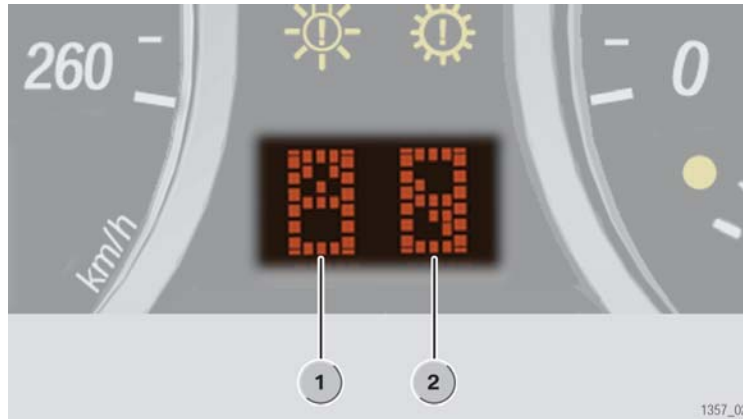
The LC display is located between the speedometer and the tachometer. With terminal 15 OFF, run-on operation is possible provided the SMG is still transmitting CAN telegrams.

The LC display is integrated in the speedometer. It has been adapted to the E85 instrument cluster and operates in the same way as that of the E46.



Program and Gear Display

In cars fitted with an automatic gearbox (5HP19) or an SMG Sequential Manual Gearbox, the program and gear display is featured in a separate LC display.



1. Program Mode
2. Drive Position

Acoustic Generators

Depending on the incident, the acoustic alarms are output once or intermittently.

The following acoustic alarms are new:

- Coolant over-temperature
- Fuel-reserve threshold



1. Acoustic Relay
2. Internal Speaker

Seat Belt Reminder

The seat-belt reminder for USA is activated with terminal 15 ON if the seat-belt contact is not closed. The acoustic alarm is intermittent and lasts for max. 6 seconds. After this time has elapsed, only the indicator and warning lamp remains lit.

Setting Buttons

The left button (S/R for Set/Reset) is used to reset the trip odometer reading, to call up the test functions and to call up the reset menu for the service interval indicator.



1. S/R - Set/Reset button

2. Clock Button

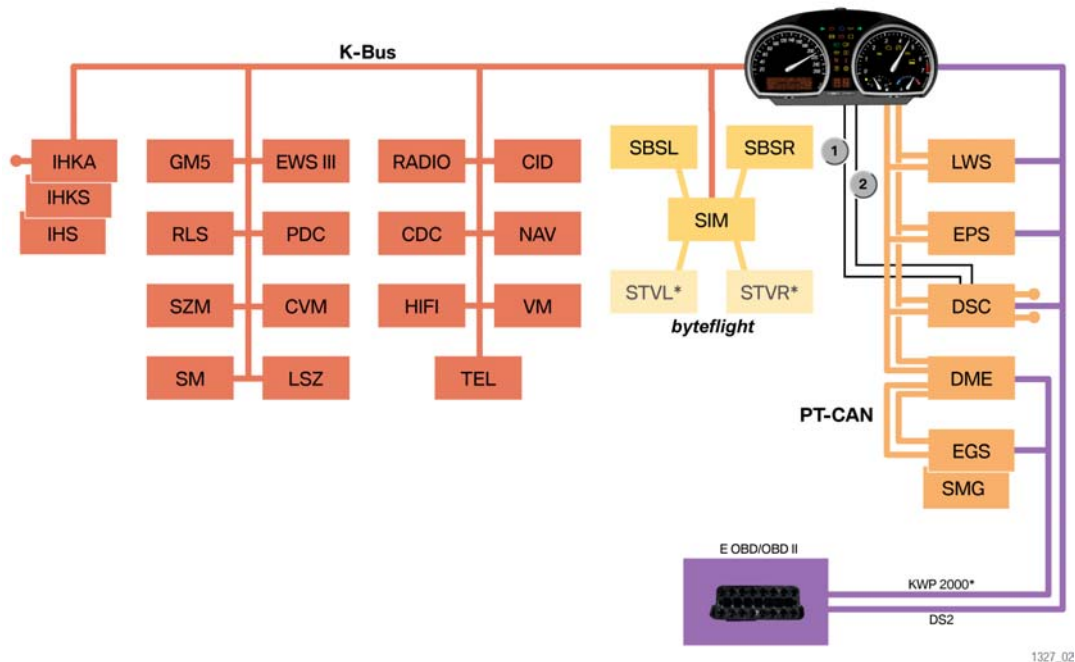
The right button (clock symbol) is used to set the time and to switch the service interval indicator (remaining distance/service date or vice versa). To set clock, press and hold button #2 until hour flashes, then tap to change hour, press and hold again until minutes appear.

System Functions

Bus Network

The instrument cluster is the central gateway (interface) for the bus network. The bus systems PT-CAN Bus, K-Bus and diagnosis bus and the bytflight are interconnected in the instrument cluster.

The bytflight is connected via the Safety and Information Module SIM (= gateway) to the K-Bus.



Instrument Cluster as Gateway

The instrument cluster is the interface between K-Bus, PT-CAN Bus and diagnosis bus. The instrument cluster communicates with other control units in the car via the K-Bus (single-wire) or the PT-CAN Bus (two-wire).

On-Board Computer

The on-board computer functions are the same as those of the E46. A new feature in the E85 is the possibility of combining time and outside temperature in the display depending on the equipment specification.

On-board computer display in navigation-system on-board monitor

In cars equipped with the High navigation system, the on-board computer functions are displayed in the pop-up on-board monitor (Central Information Display CID).

The "Distance to junction" navigation data is displayed in parallel in the instrument cluster.

Settings (e.g. units or reset) which are made at the navigation system controls using the rotary pushbutton are sent by bus telegram to the instrument cluster.

The date can be set at the navigation-system controls. The date is administered in the instrument cluster and shown in the on-board monitor.

Redundant Data Storage (RDA)

The kilometer reading/mileage and the data of the SIA service interval indicator are stored redundantly in the following control units: instrument cluster, LSZ light switch center and EWS electronic immobilizer. The above-mentioned data are thus retained when the control units are replaced.

Notes for Service

Test Functions

The test functions are used by service mechanics to check the coding. They also provide help in troubleshooting without the diagnostic tester.

The test functions are only shown in the instrument-cluster LC display.

The test functions are activated by pressing the left setting button in the instrument cluster (S/R, 5 seconds) with terminal R or terminal 15 ON. In addition, the test functions can still be called up by pressing the left setting button (S/R for Set/Reset) in the instrument cluster with simultaneous activation of terminal R.

The test functions are shown in the odometer and trip-odometer display areas in the top line of the display.

The display of the on-board computer function is retained in the bottom display line.

Test Function 19

Only the first two test functions are freely accessible. All further test functions are locked from the third test function. The lock can only be removed by means of test function 19.

In test function 19, the display switches in intervals of 1 second from L_on to L_oFF (Lock on and Lock off). The test functions are unlocked or locked by pressing the left setting button (S/R for Set/Reset).



E85 Test Functions

Example:

Test 7.1

Outside Temperature
(24.9°C)

Unlocking Test Functions

While L_off is displayed press the left setting button (S/R for Set/ Reset) in the instrument cluster. The cluster will be unlocked and all test functions are accessible. The display jumps to test function 0.

Locking Test Functions

While L_on is displayed press the left setting button (S/R for Set/Reset) in the instrument cluster. The cluster will be locked. Only tests #1 and #2 will be available while the cluster is locked.

Note: The test functions are always locked after a terminal has been changed.

Terminating Test Functions

The test functions are terminated by terminal R OFF. With terminal R ON, the test functions are exited by:

- Pressing the left setting button (S/R for Set/Reset) for longer than 5 seconds
- Calling up the test function 21

Overview of Test Functions

__tEST__0_	Exit Test Functions	__tEST__8_	ADC Values
__tEST__1_	Info roll	__tEST__8.0	ADC System Voltage
__tEST__1.0	VIN Last 5	__tEST__8.1	ADC Tank Sensors L/R
__tEST__1.1	K-Number	__tEST__8.2	ADC Brake Sensors
__tEST__1.2	BMW Part No.	__tEST__8.3	ADC Temp Sensor
__tEST__1.3	Coding Indexes	__tEST__9_	System Voltage
__tEST__1.4	Date of manufacturer	__tEST__9.0	System Voltage
__tEST__1.5	HW/SW Status	__tEST__9.1	Voltage Power Supply
__tEST__1.6	EEPROM Check Status	__tEST__9.2	ADC Brake Sensors
__tEST__1.7	CAN Index	__tEST__9.3	ADC Temp Sensor
__tEST__2_	Visual Test System	__tEST__10_	CAN Monitor
__tEST__2.0	Cluster Self Test	__tEST__10.0	DSC
__tEST__3_	SIA Information	__tEST__10.1	DME
__tEST__3.1	Liters SIA	__tEST__10.2	DME 4
__tEST__3.2	Days SIA	__tEST__11_	Not Used
__tEST__4_	Fuel Consumption	__tEST__12_	Not Used
__tEST__4.1	Consumption L/100km	__tEST__13_	Acoustic Generator
__tEST__4.2	Consumption L/Hour	__tEST__13.0	Trigger Single Sound
__tEST__5_	Range	__tEST__14_	Not Used
__tEST__5.0	Range L/100km	__tEST__15_	I/O Ports Processor
__tEST__5.1	Range current km	__tEST__16_-	Fault Memory
__tEST__6_	Fuel Level	__tEST__16.0	Number of Faults
__tEST__6.0	Tank Sensors L/R in l	__tEST__17_	Not Used
__tEST__6.1	Avg Sum Tank Sensors	__tEST__18_	Not Used
__tEST__6.2	Fuel Gauge in Liters	__tEST__19_	Lock
__tEST__7_	Display Values	__tEST__19.0	Lock on/off
__tEST__7.0	Coolant Temp °C	__tEST__20_	Not Used
__tEST__7.1	Outside Temp	__tEST__21_	Software Reset
__tEST__7.2	Engine RPM	__tEST__21.0	Reset Cluster
__tEST__7.3	Vehicle Speed		

Visual System Test

In the visual system test, all the indicator lamps and lights - with the exception of the ABS warning lamp - are activated briefly. The needle instruments are moved from the lower to upper stop and back again.



Diagnosis

Component replacement and trial replacement There are three possible combinations for replacing the instrument cluster/light switch center:

- Instrument cluster faulty, light switch center OK
- Light switch center faulty, instrument cluster OK
- Light switch center and instrument cluster must be replaced

Simultaneous replacement of the light switch center and the instrument cluster must be avoided. The odometer reading will be lost. In principle it is also possible to carry out a trial replacement of the instrument cluster/light switch center.

Car & Key Memory

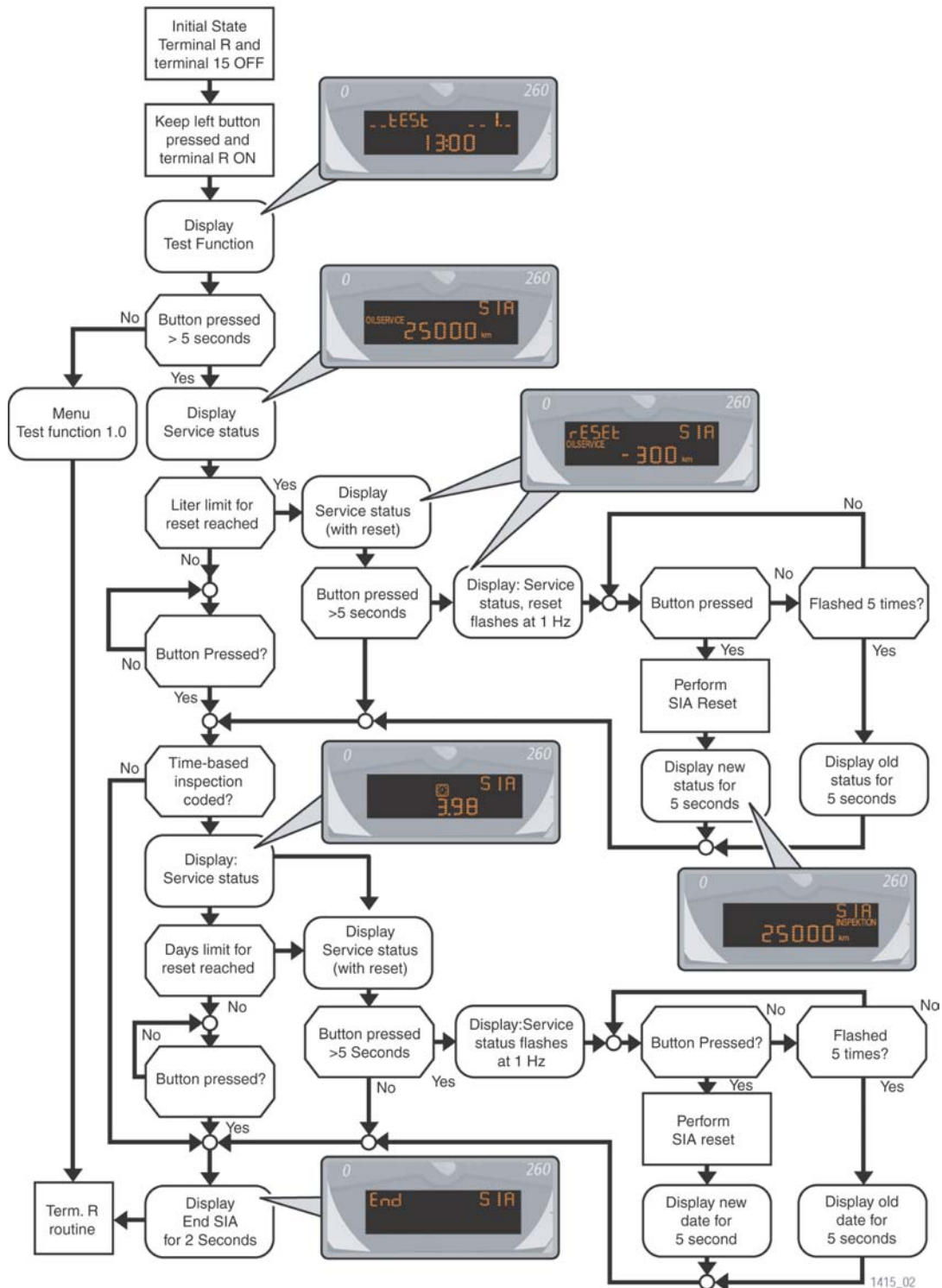
There are different car-memory functions for the E85 with regard to the display of units in the instrument cluster.

Car Memory	Setting	Explanation
Distance		The clock must be reset after the unit display has been changed
Time	12 Hr. or 24 Hr. Mode	AM/PM is also displayed in 12 hour mode
Temperature	Celsius or Fahrenheit	
Basic Setting Ice Warning	Active/Not Active	Active: If the outside temperature drops below approximately +3 Celsius (37°F), the acoustic ice warning is issued. The outside temp display will flash for several seconds and then back to current display. Not active: If the outside temp drops below 3 degrees Celsius, (Acoustic warning, Permanent Display)

SIA IV Service Interval Indicator

The present SIA IV is the service interval indicator to be found in the current E46.

Diagram of reset routine for service interval indicator





Workshop Exercise - E85 Instrument Cluster

Using an instructor designated vehicle, remove the instrument cluster and connect the appropriate breakout box and test cables. Access wiring diagrams and functional descriptions via WebTIS, GT-1 or DISplus.

There are two direct inputs to the cluster from the DSC control module. What are they used for?

Using a DVOM or the multimeter functions of the DISplus/GT-1, monitor the input signal from the outside temperature sensor. Disconnect the outside temperature sensor and note the voltage change. Also, note the temperature readout in the OBC display.

Voltage before disconnection: _____

Voltage after disconnection: _____

What happens to the outside temperature reading in the OBC display when the circuit is open?

What other systems are affected by faults in the outside temperature sensor circuit?

What type of circuit is this?

Check the resistance of both fuel tank sensors from the instrument cluster connector and record below:

How are these sensors wired to the instrument cluster? _____

What should the resistance of the fuel tank sensors be?

With a full tank: _____

With an empty tank: _____

Where are the above specification found?



Workshop Exercise - E85 Instrument Cluster

Perform the instrument cluster test functions and unlock the cluster. Access all available test functions.

Describe how to enter into the test functions:

Record the information from Test 6. to 6.2 below:

Tank sensor left: _____ liters - Tank sensor right: _____ liters

Average sum in liters: _____

Fuel gauge in liters: _____

How is this test helpful in fuel tank sensor diagnosis?

What test is used for Service Interval Information?

How is this information helpful in the shop?

Lock instrument cluster and re-install cluster using proper procedures. Re-assemble any components and restore vehicle to proper condition.



Classroom Exercise - Review Questions

1. What is the terminal 30h (KL30h) signal used for?

2. Why should the cluster and LSZ **NOT** be replaced at the same time?

3. Approximately how much fuel is left in the fuel tank when the reserve light is illuminated?

4. What is the maximum/minimum voltage range for proper cluster operation?

5. What is the operating voltage (reference voltage) of the fuel tank sensor circuit?



Classroom Exercise - Review Questions

6. What is the LSS?

7. What is the difference between the operation of the reverse light circuit on manual transmission vehicles as opposed to automatic transmission vehicles?

8. What is the difference between the two display icons shown below?
(one red, one yellow)



Yellow



Red
